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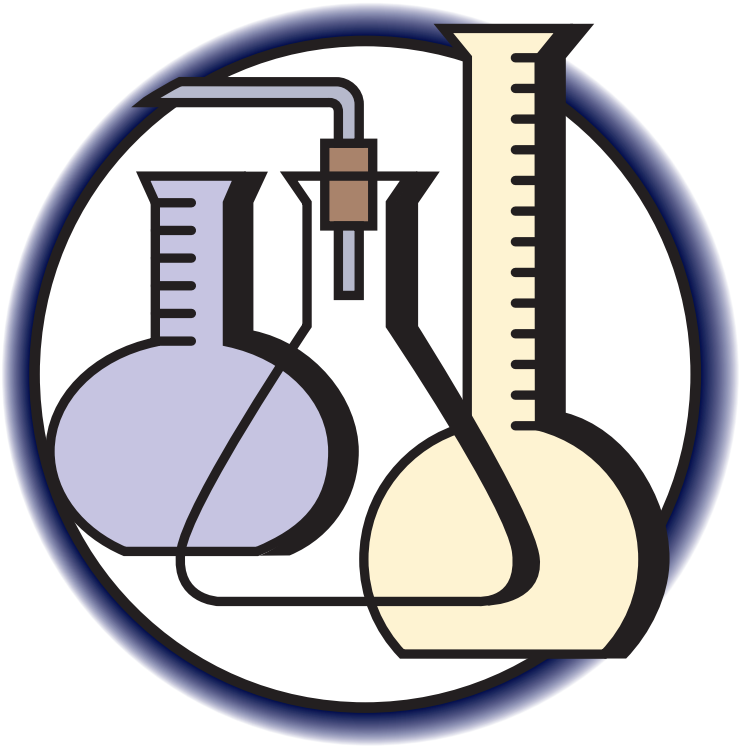
Michigan Educational Assessment Program

Assessable Content

Content Standards and Benchmarks for Science



Elementary - Middle School - High School

Elementary School

SCIENCE

CONTENT STANDARDS AND BENCHMARKS

I. Construct New Scientific and Personal Knowledge

Content Standard 1: All students will ask questions that help them learn about the world; design and conduct investigations using appropriate methodology and technology; learn from books and other sources of information; communicate their findings using appropriate technology; and reconstruct previously learned knowledge. (Constructing New Scientific Knowledge)

Elementary	Testable	Restrictions
1. Generate reasonable questions about the world based on observation.	YES	
2. Develop solutions to unfamiliar problems through reasoning, observation, and/or experiment.	YES	
3. Manipulate simple mechanical devices and explain how they work.	YES	
4. Use simple measurement devices to make metric measurement.	YES	
5. Develop strategies and skills for information gathering and problem solving.	YES	
6. Construct charts and graphs and prepare summaries of observations.	YES	

II. Reflect on the Nature, Adequacy and Connections Across Scientific Knowledge

Content Standard 1: All students will analyze claims for their scientific merit and explain how scientists decide what constitutes scientific knowledge; how science is related to other ways of knowing; how science and technology affect our society; and how people of diverse cultures have contributed to and influenced developments in science. (Reflecting on Scientific Knowledge)

Elementary	Testable	Restrictions
1. Develop an awareness of the need for evidence in making decisions scientifically.	YES	
2. Show how science concepts can be interpreted through creative expression such as language arts and fine arts.	NO	
3. Describe ways in which technology is used in everyday life.	YES	
4. Develop an awareness of and sensitivity to the natural world.	YES	
5. Develop an awareness of contributions made to science by people of diverse backgrounds.	YES	

III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts

Content Standard 1: All students will apply an understanding of cells to the functioning of multicellular organisms; and explain how cells grow, develop and reproduce. (Cells)

Elementary	Testable	Restrictions
1. Describe cells as living systems.	NO	

Content Standard 2: All students will use classification systems to describe groups of living things; compare and contrast differences in the life cycles of living things; investigate and explain how living things obtain and use energy; and analyze how parts of living things are adapted to carry out specific functions. (Organization of Living Things)

Elementary	Testable	Restrictions
1. Compare and classify familiar organisms on the basis of observable physical characteristics.	YES	
2. Describe vertebrates in terms of observable body parts and characteristics.	YES	2. Don't use the term invertebrate or vertebrate in test questions.
3. Describe life cycles of familiar organisms.	YES	
4. Compare and contrast food, energy, and environmental needs of selected organisms.	YES	
5. Describe functions of selected seed plant parts.	YES	

Content Standard 3: All students will investigate and explain how characteristics of living things are passed on through generations; explain why organisms within a species are different from one another; and explain how new traits can be established by changing or manipulating genes. (Heredity)

Elementary	Testable	Restrictions
1. Give evidence that characteristics are passed from parents to young.	YES	

Content Standard 4: All students will explain how scientists construct and scientifically test theories concerning the origin of life and evolution of species; compare ways that living organisms are adapted (suited) to survive and reproduce in their environments; and analyze how species change through time. (Evolution)

Elementary	Testable	Restrictions
1. Explain how fossils provide evidence about the nature of ancient life.	YES	
2. Explain how physical and/or behavioral characteristics of organisms help them to survive in their environments.	YES	2. Don't use word vertebrate in test questions.

Content Standard 5: All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact. (Ecosystems)

Elementary	Testable	Restrictions
1. Identify familiar organisms as part of a food chain or food web and describe their feeding relationships within the web.	YES	1. Don't use concept of foodweb. Food chain is the only concept to be assessed.
2. Explain common patterns of interdependence and interrelationships of living things.	YES	2. Don't use words symbiotic or parasitic relationships on test.
3. Describe the basic requirements for all living things to maintain their existence.	YES	
4. Design systems that encourage growing of particular plants or animals.	YES	
5. Describe positive and negative effects of humans on the environment.	YES	

IV. Use Scientific Knowledge from the Physical Sciences in Real-World Contexts

Content Standard 1: All students will measure and describe the things around us; explain what the world around us is made of; identify and describe forms of energy; and explain how electricity and magnetism interact with matter. (Matter and Energy)

Elementary	Testable	Restrictions
1. Classify common objects and substances according to observable attributes: color, size, shape, smell, hardness, texture, flexibility, length, weight, buoyancy, states of matter, or magnetic properties.	YES	
2. Measure weight, dimensions, and temperature of appropriate objects and materials.	YES	
3. Identify properties of materials which make them useful.	YES	
4. Identify forms of energy associated with common phenomena.	YES	
5. Describe the interaction of magnetic materials with other magnetic and non-magnetic materials.	YES	
6. Describe the interaction of charged materials with other charged or uncharged materials.	YES	
7. Describe possible electrical hazards to be avoided at home and at school.	YES	

Content Standard 2: All students will investigate, describe and analyze ways in which matter changes; describe how living things and human technology change matter and transform energy; explain how visible changes in matter are related to atoms and molecules; and how changes in matter are related to changes in energy. (Changes in Matter)

Elementary	Testable	Restrictions
1. Describe common physical changes in matter—size, shape, melting, freezing, dissolving.	YES	
2. Prepare mixtures and separate them into their component parts.	YES	2. Don't use the words sieves, distillations, or solar stills.

Elementary	Testable	Restrictions
3. Construct simple objects that fulfill a technological purpose.	YES	

Content Standard 3: All students will describe how things around us move and explain why things move as they do; demonstrate and explain how we control the motions of objects; and relate motion to energy and energy conversions. (Motion of Objects)

Elementary	Testable	Restrictions
1. Describe or compare motions of common objects in terms of speed and direction.	YES	
2. Describe how forces (pushes or pulls) are needed to speed up, slow down, stop, or change the direction of a moving object.	YES	
3. Use simple machines to make work easier.	YES	

Content Standard 4: All students will describe sounds and sound waves; explain shadows, color, and other light phenomena; measure and describe vibrations and waves; and explain how waves and vibrations transfer energy. (Waves and Vibrations)

Elementary	Testable	Restrictions
1. Describe sounds in terms of their properties (pitch, loudness).	YES	
2. Explain how sounds are made.	YES	
3. Describe light from a light source in terms of its properties.	YES	
4. Explain how light illuminates objects.	YES	
5. Explain how shadows are made.	YES	

V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard 1: All students will describe the earth's surface; describe and explain how the earth's features change over time; and analyze effects of technology on the earth's surface and resources. (Geosphere)

Elementary	Taxable	Restrictions
1. Describe major features of the earth's surface.	YES	
2. Recognize and describe different types of earth materials.	YES	
3. Explain how rocks and fossils are used to understand the history of the earth.	YES	
4. Describe natural changes in the earth's surface.	YES	
5. Describe uses of materials taken from the earth.	YES	
6. Demonstrate means to recycle manufactured materials and a disposition toward recycling.	YES	

Content Standard 2: All students will demonstrate where water is found on earth; describe the characteristics of water and how water moves; and analyze the interaction of human activities with the hydrosphere. (Hydrosphere)

Elementary	Testable	Restrictions
1. Describe how water exists on earth in three states.	YES	
2. Trace the path that rain water follows after it falls.	YES	
3. Identify sources of drinking water.	YES	
4. Describe uses of water.	YES	

Content Standard 3: All students will investigate and describe what makes up weather and how it changes from day to day, from season to season and over long periods of time; explain what causes different kinds of weather; and analyze the relationships between human activities and the atmosphere. (Atmosphere and Weather)

Elementary	Testable	Restrictions
1. Describe the atmosphere.	YES	
2. Describe weather conditions and climates.	YES	2. Eliminate concept about climates.
3. Describe seasonal changes in weather.	YES	
4. Explain appropriate safety precautions during severe weather.	YES	

Content Standard 4: All students will compare and contrast our planet and sun to other planets and star systems; describe and explain how objects in the solar system move; explain scientific theories as to the origin of the solar system; and explain how we learn about the universe. (Solar System, Galaxy and Universe)

Elementary	Testable	Restrictions
1. Describe the sun, moon and earth.	YES	
2. Describe the motions of the earth and moon around the sun.	YES	

Middle School

SCIENCE
CONTENT STANDARDS AND WORKING DRAFT BENCHMARKS

I. Construct New Scientific and Personal Knowledge

Content Standard 1: All students will ask questions that help them learn about the world; design and conduct investigations using appropriate methodology and technology; learn from books and other sources of information; communicate their findings using appropriate technology; and reconstruct previously learned knowledge. (Constructing New Scientific Knowledge)

Middle School	Testable	Restrictions
1. Generate scientific questions about the world based on observation.	YES	
2. Design and conduct simple investigations.	YES	
3. Investigate toys/simple appliances and explain how they work, using instructions and appropriate safety precautions.	YES	
4. Use measurement devices to provide consistency in an investigation.	YES	
5. Use sources of information to help solve problems.	YES	
6. Write and follow procedures in the form of step-by-step instructions, recipes, formulas, flow diagrams, and sketches.	YES	

II. Reflect on the Nature, Adequacy and Connections Across Scientific Knowledge

Content Standard 1: All students will analyze claims for their scientific merit and explain how scientists decide what constitutes scientific knowledge; how science is related to other ways of knowing; how science and technology affect our society; and how people of diverse cultures have contributed to and influenced developments in science. (Reflecting on Scientific Knowledge)

Middle School	Testable	Restrictions
1. Evaluate the strengths and weaknesses of claims, arguments, or data.	YES	
2. Describe limitations in personal knowledge.	YES	
3. Show how common themes of science, mathematics, and technology apply in real-world contexts.	YES	
4. Describe the advantages and risks of new technologies.	YES	
5. Recognize the contributions made in science by cultures and individuals of diverse backgrounds.	YES	

III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts

Content Standard 1: All students will apply an understanding of cells to the functioning of multicellular organisms; and explain how cells grow, develop and reproduce. (Cells)

Middle School	Testable	Restrictions
1. Describe similarities/ differences between single-celled and multicellular organisms.	YES	
2. Explain why specialized cells are needed by plants and animals.	YES	
3. Explain how cells use food as a source of energy.	YES	

Content Standard 2: All students will use classification systems to describe groups of living things; compare and contrast differences in the life cycles of living things; investigate and explain how living things obtain and use energy; and analyze how parts of living things are adapted to carry out specific functions. (Organization of Living Things)

Middle School	Testable	Restrictions
1. Compare and classify organisms into major groups on the basis of their structure.	YES	
2. Describe the life cycle of a flowering plant.	YES	
3. Describe evidence that plants make and store food.	YES	
4. Explain how selected systems and processes work together in plants and animals.	YES	

Content Standard 3: All students will investigate and explain how characteristics of living things are passed on through generations; explain why organisms within a species are different from one another; and explain how new traits can be established by changing or manipulating genes. (Heredity)

Middle School	Testable	Restrictions
1. Describe how the characteristics of living things are passed on through generations.	YES	
2. Describe how heredity and environment may influence/determine characteristics of an organism.	YES	

Content Standard 4: All students will explain how scientists construct and scientifically test theories concerning the origin of life and evolution of species; compare ways that living organisms are adapted (suited) to survive and reproduce in their environments; and analyze how species change through time. (Evolution)

Middle School	Testable	Restrictions
1. Describe how scientific theory traces possible evolutionary relationships among present and past life forms.	YES	

Content Standard 5: All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact. (Ecosystems)

Middle School	Testable	High School
1. Describe common patterns of relationships among populations.	YES	
2. Predict the effects of changes in one population in a food web on other populations	YES	
3. Describe how all organisms in an ecosystem acquire energy directly or indirectly from sunlight.	YES	
4. Describe the likely succession of a given ecosystem over time.	YES	
5. Identify some common materials that cycle through the environment.	YES	

Middle School	Testable	High School
6. Describe ways in which humans alter the environment.	YES	
7. Explain how humans use and benefit from plant and animal materials.	YES	

IV. Use Scientific Knowledge from the Physical Sciences in Real-World Contexts

Content Standard 1: All students will measure and describe the things around us; explain what the world around us is made of; identify and describe forms of energy; and explain how electricity and magnetism interact with matter. (Matter and Energy)

Middle School	Testable	Restrictions
1. Measure physical properties of objects or substances (mass, weight, area, temperature, dimensions, volume).	YES	
2. Describe when length, mass, weight, area, or volume are appropriate to describe the size of an object or the amount of a substance.	YES	
3. Classify substances as elements, compounds, or mixtures.	YES	
4. Describe matter as consisting of extremely small particles (atoms) which bond together to form molecules.	YES	4. Don't use the word bond in items.
5. Describe the arrangement and motion of molecules in solids, liquids, and gases.	YES	
6. Describe energy and the many common forms it takes (mechanical, heat, light, sound, electrical, magnetic, chemical, nuclear).	YES	
7. Describe how common forms of energy can be converted, one to another.	YES	7. Conversion of energy is OK, but don't use conservation of energy .
8. Describe electron flow in simple electrical circuits.	YES	8. Don't use the word electron flow in items. If graphical representation, don't label positive or negative charges on batteries.
9. Use electric currents to create magnetic fields.	YES	

Content Standard 2: All students will investigate, describe and analyze ways in which matter changes; describe how living things and human technology change matter and transform energy; explain how visible changes in matter are related to atoms and molecules; and how changes in matter are related to changes in energy. (Changes in Matter)

Middle School	Testable	Restrictions
1. Describe common physical changes in materials: evaporation, condensation, thermal expansion, and contraction.	YES	
2. Describe common chemical changes in terms of properties of reactants and products.	YES	
3. Distinguish between physical and chemical changes in natural and technological systems.	YES	
4. Describe how waste products accumulating from natural and technological activity create pollution.	YES	
5. Explain physical changes in terms of the arrangement and motion of atoms and molecules.	YES	

Content Standard 3: All students will describe how things around us move and explain why things move as they do; demonstrate and explain how we control the motions of objects; and relate motion to energy and energy conversions. (Motion of Objects)

Middle School	Testable	Restrictions
1. Qualitatively describe and compare motions in three dimensions.	YES	
2. Relate changes in speed or direction to unbalanced forces in two dimensions.	YES	
3. Describe the forces exerted by magnets, electrically charged objects, and gravity.	YES	
4. Design strategies for moving objects by application of forces, including the use of simple machines.	YES	

Content Standard 4: All students will describe sounds and sound waves; explain shadows, color, and other light phenomena; measure and describe vibrations and waves; and explain how waves and vibrations transfer energy. (Waves and Vibrations)

Middle School	Testable	Restrictions
1. Explain how sound travels through different media.	YES	
2. Explain how echoes occur and how they are used.	YES	
3. Explain how light helps us to see.	YES	3. Don't use eye anatomy in items.
4. Explain how objects or media reflect, refract, transmit, or absorb light.	YES	
5. Describe the motion of pendulums or vibrating objects (frequency, amplitude).	YES	
6. Explain how waves transmit energy.	YES	

V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard 1: All students will describe the earth's surface; describe and explain how the earth's features change over time; and analyze effects of technology on the earth's surface and resources. (Geosphere)

Middle School	Testable	Restrictions
1. Describe and identify surface features using maps.	YES	
2. Explain how rocks and minerals are formed.	YES	
3. Explain how rocks and fossils are used to determine the age and geological history of the earth.	YES	
4. Explain how rocks are broken down, how soil is formed and how surface features change.	YES	
5. Explain how technology changes the surface of the earth.	YES	

Content Standard 2: All students will demonstrate where water is found on earth; describe the characteristics of water and how water moves; and analyze the interaction of human activities with the hydrosphere. (Hydrosphere)

Middle School	Testable	Restrictions
1. Describe various forms that water takes on the earth's surface and conditions under which they exist.	YES	
2. Describe how rain water in Michigan reaches the oceans.	YES	2. Don't use words tide and thermal layering in items.
3. Describe the origins of pollution in the hydrosphere.	YES	

Content Standard 3: All students will investigate and describe what makes up weather and how it changes from day to day, from season to season and over long periods of time; explain what causes different kinds of weather; and analyze the relationships between human activities and the atmosphere. (Atmosphere and Weather)

Middle School	Testable	Restrictions
1. Describe the composition and characteristics of the atmosphere.	YES	
2. Describe patterns of changing weather and how they are measured.	YES	2. Illustrations must use representations of conventional system and symbols.
3. Explain the water cycle and its relationship to weather patterns.	YES	
4. Describe health effects of polluted air.	YES	

Content Standard 4: All students will compare and contrast our planet and sun to other planets and star systems; describe and explain how objects in the solar system move; explain scientific theories as to the origin of the solar system; and explain how we learn about the universe. (Solar System, Galaxy and Universe)

Middle School	Testable	Restrictions
1. Compare the earth to other planets in terms of supporting life.	YES	1. Don't use term <u>fall</u> when referring to "fall to planet" in objective.
2. Describe, compare, and explain the motions of planets, moons, and comets in the solar system.	YES	
3. Describe and explain common observations of the day and night skies.	YES	
4. Explain current scientific thinking about how the solar system formed.	YES	

High School

SCIENCE
CONTENT STANDARDS AND WORKING DRAFT BENCHMARKS

I. Construct New Scientific and Personal Knowledge

Content Standard 1: All students will ask questions that help them learn about the world; design and conduct investigations using appropriate methodology and technology; learn from books and other sources of information; communicate their findings using appropriate technology; and reconstruct previously learned knowledge. (Constructing New Scientific Knowledge)

High School	Testable	Restrictions
1. Develop questions or problems for investigation that can be answered empirically.	YES	
2. Suggest empirical tests of hypotheses.	YES	
3. Design and conduct scientific investigations.	YES	
4. Diagnose possible reasons for failures of mechanical or electronic systems.	YES	
5. Assemble mechanical or electronic systems using appropriate tools and instructions.	NO	
6. Recognize and explain the limitations of measuring devices.	YES	
7. Gather and synthesize information from books and other sources of information.	YES	
8. Discuss topics in groups by being able to restate or summarize what others have said, ask for clarification or elaboration, and take alternative perspectives.	YES	
9. Reconstruct previously learned knowledge.	NO	

II. Reflect on the Nature, Adequacy and Connections Across Scientific Knowledge

Content Standard 1: All students will analyze claims for their scientific merit and explain how scientists decide what constitutes scientific knowledge; how science is related to other ways of knowing; how science and technology affect our society; and how people of diverse cultures have contributed to and influenced developments in science. (Reflecting on Scientific Knowledge)

High School	Testable	Restrictions
1. Justify plans or explanations on a theoretical or empirical basis.	YES	
2. Describe some general limitations of scientific knowledge.	YES	
3. Show how common themes of science, mathematics, and technology apply in real-world contexts.	YES	
4. Discuss the historical development of key scientific concepts and principles.	YES	
5. Evaluate alternative long range plans for resource use and by-product disposal in terms of environmental and economic impact.	YES	
6. Describe the historical, political, and social factors affecting developments in science.	YES	

III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts

Content Standard 1: All students will apply an understanding of cells to the functioning of multicellular organisms; and explain how cells grow, develop and reproduce. (Cells)

High School	Testable	Restrictions
1. Classify cells/organisms on the basis of organelle and/or cell types.	YES	
2. Explain how multicellular organisms grow, based on how cells grow and reproduce.	YES	
3. Compare and contrast ways in which selected cells are specialized to carry out particular life functions.	YES	
4. Compare and contrast the chemical composition of selected cell types.	NO	
5. Compare the transformations of matter and energy during photosynthesis and respiration.	YES	
6. Explain how essential materials move into cells and how waste and other materials get out.	YES	
7. Explain how cells use food to grow.	YES	

Content Standard 2: All students will use classification systems to describe groups of living things; compare and contrast differences in the life cycles of living things; investigate and explain how living things obtain and use energy; and analyze how parts of living things are adapted to carry out specific functions. (Organization of Living Things)

High School	Testable	Restrictions
1. Classify major groups of organisms on the basis of the five-kingdom system.	YES	
2. Describe the life cycle of an organism associated with human disease.	YES	
3. Explain the process of food storage and food use in organisms.	YES	

High School	Testable	Restrictions
4. Explain how living things maintain a stable internal environment.	YES	
5. Describe technology used in the prevention, diagnosis, and treatment of diseases.	YES	

Content Standard 3: All students will investigate and explain how characteristics of living things are passed on through generations; explain why organisms within a species are different from one another; and explain how new traits can be established by changing or manipulating genes. (Heredity)

High School	Testable	Restrictions
1. Explain how characteristics of living things are passed on from generation to generation.	YES	
2. Describe how genetic material is passed from parent to young during sexual and asexual reproduction.	YES	
3. Explain how new traits may be established in individuals/ populations through changes in genetic material (DNA).	YES	

Content Standard 4: All students will explain how scientists construct and scientifically test theories concerning the origin of life and evolution of species; compare ways that living organisms are adapted (suited) to survive and reproduce in their environments; and analyze how species change through time. (Evolution)

High School	Testable	Restrictions
1. Describe what biologists consider to be evidence for human evolutionary relationships to selected animal groups.	YES	
2. Explain how a new species or variety may originate through the evolutionary process of natural selection.	YES	
3. Explain how new traits might arise and become established in a population.	YES	

Content Standard 5: All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact. (Ecosystems)

High School	Testable	Restrictions
1. Describe common ecological relationships among species.	YES	
2. Explain how energy flows through familiar ecosystems.	YES	
3. Describe general factors regulating population size in ecosystems.	YES	
4. Describe responses of an ecosystem to events that cause it to change.	YES	
5. Describe how water, carbon dioxide, and soil nutrients cycle through selected ecosystems.	YES	
6. Explain the effects of agriculture and other human activities on selected ecosystems.	YES	

IV. Use Scientific Knowledge from the Physical Sciences in Real-World Contexts

Content Standard 1: All students will measure and describe the things around us; explain what the world around us is made of; identify and describe forms of energy; and explain how electricity and magnetism interact with matter. (Matter and Energy)

High School	Testable	Restrictions
1. Describe and compare objects in terms of mass, volume, and density.	YES	
2. Explain how families of elements are related by common properties.	YES	
3. Analyze properties of common household and agricultural materials in terms of risk/benefit balance.	YES	
4. Describe and explain the structural parts and electrical charges of atoms.	YES	
5. Describe how energy is conserved during transformations.	YES	
6. Explain changes in matter and energy involving heat transfer.	YES	
7. Describe how electric currents can be produced by interacting wires and magnets.	YES	
8. Construct and explain simple circuits using wires, light bulbs, fuses, switches, and power sources.	YES	

Content Standard 2: All students will investigate, describe and analyze ways in which matter changes; describe how living things and human technology change matter and transform energy; explain how visible changes in matter are related to atoms and molecules; and how changes in matter are related to changes in energy. (Changes in Matter)

High School	Testable	Restrictions
1. Explain how mass is conserved in physical and chemical changes.	YES	
2. Describe nuclear changes in terms of the properties of reactants and products.	YES	

High School	Testable	Restrictions
3. Trace, to an original source, the energy used by living things and machines.	YES	
4. Describe how common materials are made and disposed of or recycled.	YES	
5. Explain chemical changes in terms of the arrangement and motion of atoms and molecules.	YES	
6. Describe, compare, and contrast changes in atoms and/or molecules during physical, chemical, and nuclear changes.	YES	
7. Describe energy changes associated with physical and chemical changes.	YES	
8. Describe, compare and contrast relative magnitudes of energy changes involved in physical, chemical and nuclear changes.	YES	

Content Standard 3: All students will describe how things around us move and explain why things move as they do; demonstrate and explain how we control the motions of objects; and relate motion to energy and energy conversions. (Motion of Objects)

High School	Testable	Restrictions
1. Perform measurements and calculations to describe the speed and direction of an object.	YES	
2. Describe that whenever one object exerts a force on a second object, the second object exerts an equal and opposite force on the first object.	YES	
3. Analyze the operation of machines in terms of force and motion.	YES	
4. Explain energy conversions in moving objects and in simple machines.	YES	

Content Standard 4: All students will describe sounds and sound waves; explain shadows, color, and other light phenomena; measure and describe vibrations and waves; and explain how waves and vibrations transfer energy. (Waves and Vibrations)

High School	Testable	Restrictions
1. Relate characteristics of sounds that we hear to properties of sound waves.	YES	
2. Explain how sound recording and reproducing devices work.	NO	
3. Relate colors to wavelengths of light.	YES	
4. Explain how we see colors of objects.	YES	
5. Describe different types of waves and their technological applications.	YES	
6. Describe waves in terms of their properties (frequency, amplitude, wavelength, wave velocity).	YES	
7. Describe the behavior of waves when they interact.	YES	
8. Relate changes in detected frequency of a source to the motion of the source and/or the detector.	YES	
9. Explain how energy is stored and transformed in vibrating and oscillating objects.	YES	

V. Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts

Content Standard 1: All students will describe the earth's surface; describe and explain how the earth's features change over time; and analyze effects of technology on the earth's surface and resources. (Geosphere)

High School	Testable	Restrictions
1. Explain the surface features of the Great Lakes region using Ice Age theory.	YES	
2. Use the plate tectonics theory to explain features of the earth's surface and geological phenomena and describe evidence for the plate tectonics theory.	YES	
3. Explain how and why earth materials are conserved and recycled.	YES	

Content Standard 2: All students will demonstrate where water is found on earth; describe the characteristics of water and how water moves; and analyze the interaction of human activities with the hydrosphere. (Hydrosphere)

High School	Testable	Restrictions
1. Explain how water moves below the earth's surface.	YES	
2. Explain relationships between the hydrosphere, regional climates, and human activities.	YES	
3. Describe how human activities affect the quality of water in the hydrosphere.	YES	

Content Standard 3: All students will investigate and describe what makes up weather and how it changes from day to day, from season to season and over long periods of time; explain what causes different kinds of weather; and analyze the relationships between human activities and the atmosphere. (Atmosphere and Weather)

High School	Testable	Restrictions
1. Describe patterns of air movement in the atmosphere and how they affect weather conditions.	YES	
2. Explain and predict general weather patterns and storms.	YES	

High School	Testable	Restrictions
3. Explain changes in climate over long periods of time.	YES	

Content Standard 4: All students will compare and contrast our planet and sun to other planets and star systems; describe and explain how objects in the solar system move; explain scientific theories as to the origin of the solar system; and explain how we learn about the universe. (Solar System, Galaxy and Universe)

High School	Testable	Restrictions
1. Describe the position and motion of our solar system in the universe.	YES	
2. Explain why seasons occur on earth.	YES	
3. Explain how stars form and how they produce energy.	YES	
4. Explain how technology and scientific inquiry have helped us learn about the universe.	YES	